



Biogas i DK

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Publication date:
2014

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Citation (APA):
Klinge Jacobsen, H. (Author), & Münster, M. (Author). (2014). Biogas i DK. Sound/Visual production (digital)

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Biogas i DK

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25/2 2014 Østfold Forskning

BioValueChain Workshop 24-26 January 2014, Fredrikstad



Denmark and biogas production

Denmark

- Population: 5.6 million (116/km²)
- Total area: 43.098 km²
- Arable land: 2.6 million hectares (64 %)
- Cattle: 1.6 million (dairy cattle 550.000)
- Pigs: 12.5 million

Greenhouse gas from agricultural sector: 18%
(Global average 13.5%)



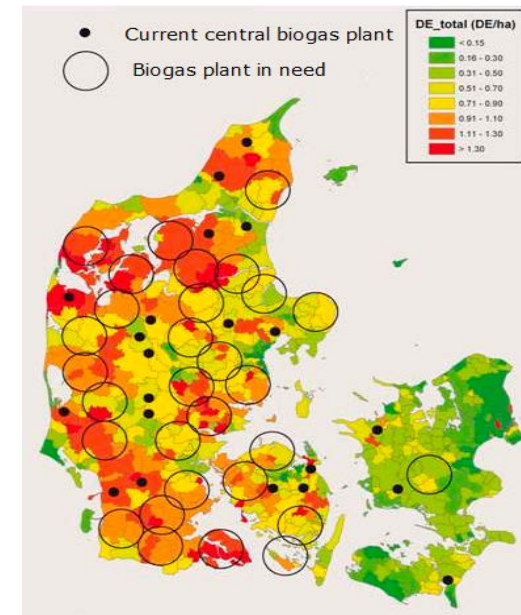
- Energy and environment strategy
 - No fossil fuel by 2050
 - 50% of animal manure for biogas production by 2020



www.at-rejse-er-at-leve.dk

Biogas production in Denmark

- First generation from 1978 meant to provide a substitute during the oil crisis :
Failure due to lack of experience
- Second generation from 1984
 - A large scale central biogas plant (run by engineers)
 - Co-digestion (Bigadan in 1986)
 - Denmark the first country using co-digestion
 - Economic profitability (building 20 central plants by 1998)
- Dark Period from 1998-2011
 - No new central biogas plants
 - Energy efficiency policy by new government)
- Current state
 - 22 central biogas plants
 - over 65 farm scale plants
- New Momentum
 - Goal: 10 fold increase in biogas production by 2020

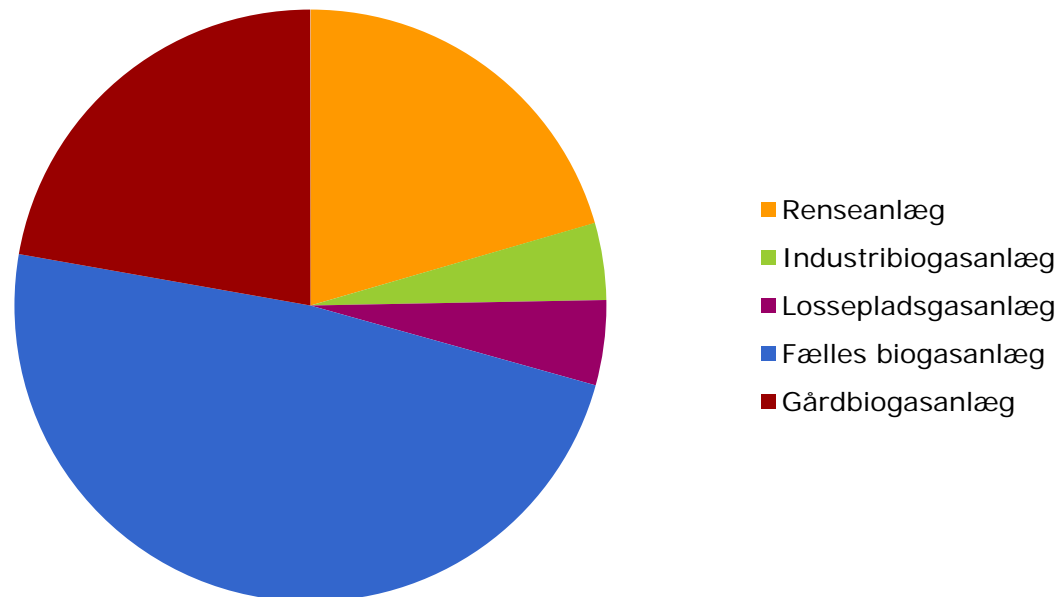


○ Needed Biogas plants (30 more)

● Current central biogas plants (22 plants)

DK produktion 2012

Produktion 2012
(Total 4,4 PJ)

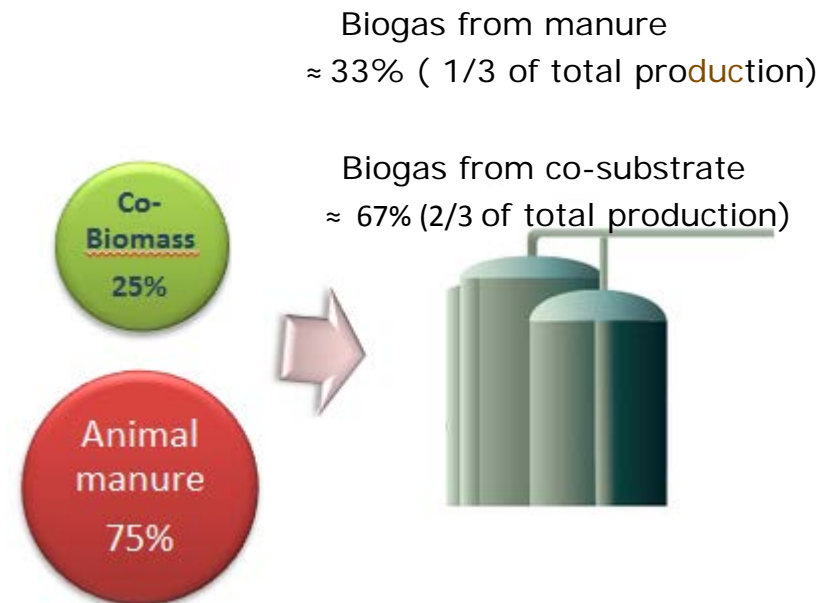


<http://www.ens.dk/info/nyheder/nyhedsarkiv/brug-majs-energiagroeder-biogas-falder>

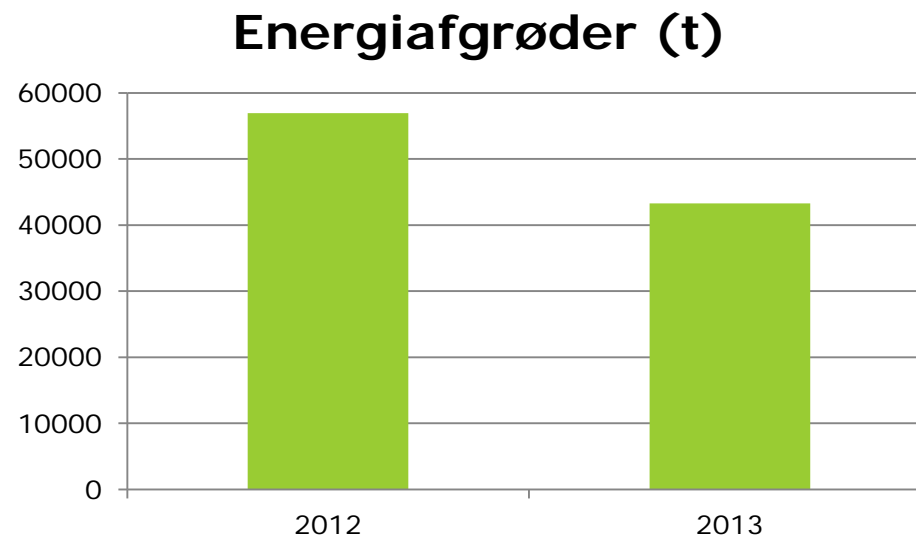
Co-digestion

Limited availability of biomass

- Problem : Energy potentials of animal manure → LOW
- Biomass needs to be mixed to boost "BIOGAS YIELD".
- Otherwise no profitability in biogas plants
- Current co-biomass used up (import)
- Biomass not available for new biogas plants
- Integration of underutilized biomass
- Issue of new biomass but little knowledge on energy potentials



Brug af energiafgrøder (majs, roer og græs)

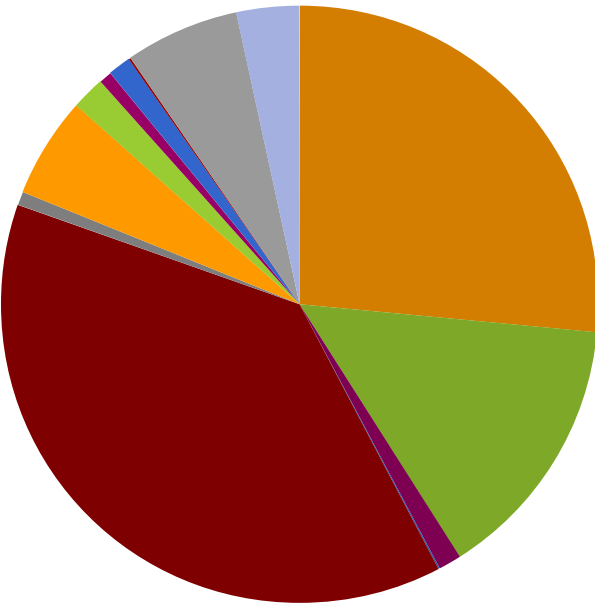


<http://www.ens.dk/info/nyheder/nyhedsarkiv/brug-majs-energiagroeder-biogas-falder>

DK AD biomasse potentialer

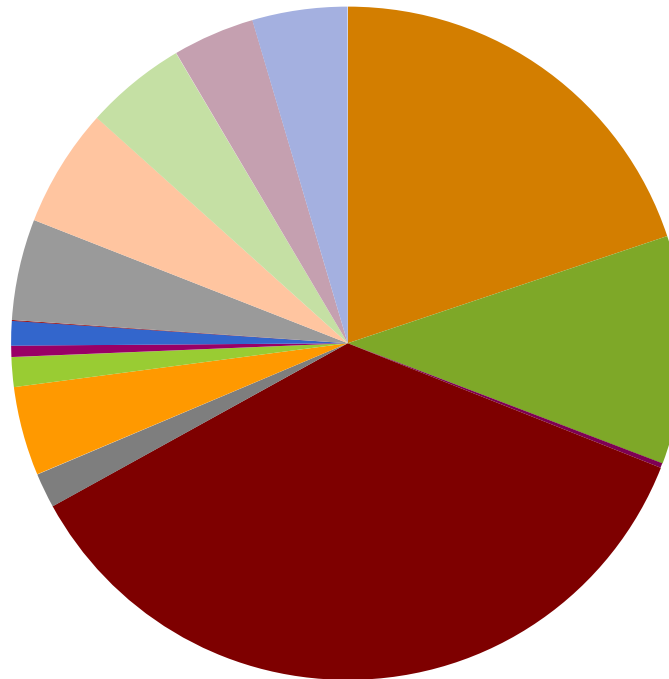
Potentiale 2012

(Total ~1400 mio Nm³ CH₄
eller ~50 PJ)



Potentiale 2020

(Total ~1750 mio Nm³ CH₄
eller ~60 PJ)



- Gylle, VS/TS=80 %
- Dybstrøelse, VS/TS=80 %
- Fast staldgødning, VS/TS=80 %
- Ajle, VS/TS=80 %
- Halm, VS/TS=95 %
- Efterafgrøder, VS/TS=90 %
- Naturarealer, VS/TS=90 %
- Randzoner, VS/TS=90 %
- Grøftekanter, VS/TS=90 %
- Have-parkaffald, VS/TS=90 %
- Akvatiske biomasser, VS/TS=90 %
- Husholdningsaffald, VS/TS=90 %
- Energimajs, VS/TS=95 %
- Energiroer, VS/TS=95 %
- Kløvergræs, VS/TS=90 %
- Roetopensilage, VS/TS=90 %

Usikkerheder på +/- 50% for flere biomasser

Industriaffald ikke opgjort. Mængden af husholdningsaffald forventes at falde, men det er uvist hvor meget.

For majs, roer og kløvergræs = 12 % af inputtet af forventet biomasse

<http://www.ens.dk/undergrund-forsyning/vedvarende-energi/bioenergi/biogas-taskforce/biomasse-biogas>

Organisk husholdningsaffald I

Grindsted renseanlæg siden 1997

(Samforgasning med spildevand)

• Ind

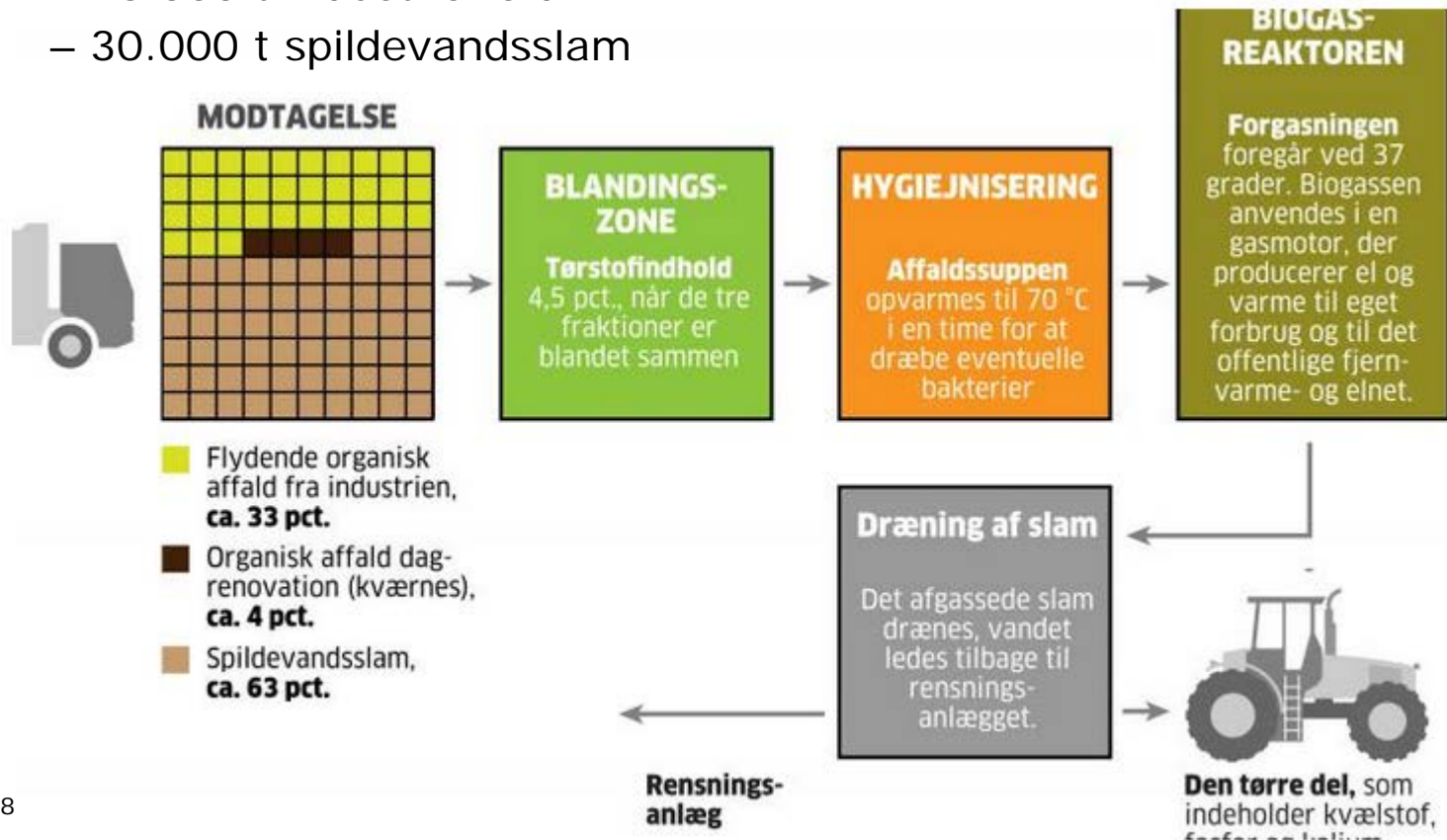
- 1.900 t sorteret husholdningsaffald (Billund/Grindsted)
- 16.000 t industriaffald
- 30.000 t spildevandsslam

• Ud

- > 1.28 mio Nm³ CH₄ (46 TJ)

<http://ing.dk/artikel/billund-vand-har-lavet-biogas-af-madaffald-i-15-ar-127927>

<http://www.billundvand.dk/energi>



Organisk husholdningsaffald II

Aikan, Holbæk siden 2003

(Tør bioforgasning)

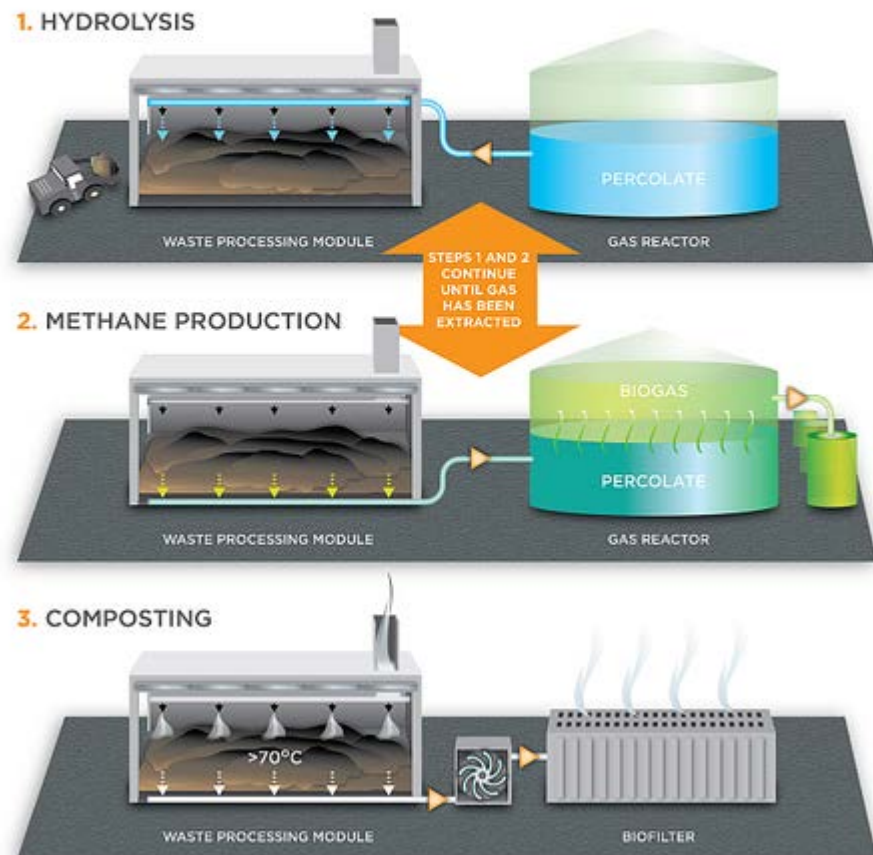
(9 nordvestsjællandske kommuner)

- Ind
 - 18.000 t sorteret husholdningsaffald
 - 5.000 t haveaffald
 - 4.000 t spildevandsslam
- Ud
 - > 1 mio Nm³ CH₄ (36 TJ)
 - > 6.000 t kompost

<http://www.aikantechnology.com/documentation/projects.html>

<http://www.aikantechnology.com/how-it-works/batch-processing.html>

THE AIKAN 3-STEP PROCESS



Forskning

- Mere biomasse til biogas produktion
 - **gylle** – separering/ vådekspllosion og efterbehandling af fiberfraktion og foderstrategier
 - **husholdningsaffald** – REnescience (blandet affald - trykkogning og enzymer)/ AIKAN (sorteret affald - tør bioforgasning)/N.C. Miljø (blandet affald - mekanisk sortering)
 - **halm** – ekstrudering/ trykkogning/ syre/base behandling/ brikketering
 - **dybstrøelse** – forbehandling/ håndtering
 - **alger og tang** – biogaspotentialer
 - **efterafrøder** – biogaspotentialer
 - **energiafrøder** (pil, elefantgræs, ensileret græs, hvedehalm) – neddeling/ vådekspllosion
 - **slam** – flashbehandling og kemisk/termisk hydrolyse

Forskning II

- **Procesoptimering**

- processtyring og biosensorer
- brintkontrol
- skumkontrol
- seriedrift
- optimeret gårdbiogasanlæg
- samproduktion med bioethanol
- reaktor omrøringsprocedurer
- regulering og styring af kraftvarme
- måling og reduktion af emissioner

- **Opgradering** af biogas til naturgaskvalitet (bl.a. ved tilsætning af brint)
 - kemisk og biologisk (SYMBIO, Sabatier, Electrochaea, membran, SOEC)

- **Transmission**

- Biogas transmissionsnet
- Rammebetingelser for biogas i naturgasnettet

<http://www.energiforskning.dk>

<http://www.biopress.dk/artikler/artikler-biogas-kronologisk>